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(54) Title: GRAPHICAL USER INTERFACE FOR A WIRELESS COMMUNICATION DEVICE

(57) Abstract

A wireless communications device (106) uses graphic image data to simplify the calling process. The user may enter desired destination telephone numbers (168, 170, 172) that are associated with a selected graphic image (160, 162, 164). The user may subsequently recall the desired destination telephone number simply by selecting the associated graphic image. The system may include scroll buttons (120) to position the desired graphic image in a predetermined position or may include a touch-sensitive screen (124) so that the user may initiate a phone call simply by pressing the desired portion of the touch-sensitive screen. In addition, a call history profile is maintained using destination telephone numbers and associated graphic images. The graphic images can be represented in different manners to indicate the frequency with which the associated telephone number has been called or to indicate the chronological sequence in which telephone numbers have been called. In addition, the system may include an input interface to allow the user to download graphic images from an external source, such as a computer. The downloaded images may include digitized photographs so that the associated graphic image will be readily recognizable to the user.
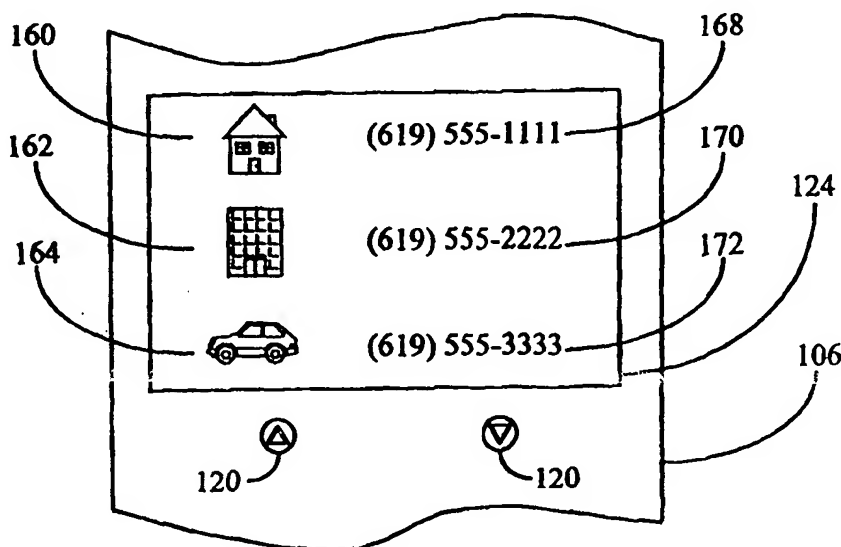
# GRAPHICAL USER INTERFACE FOR A WIRELESS COMMUNICATION DEVICE

## I. FIELD OF THE INVENTION

The present invention is related generally to a wireless communication
device, and more particularly, to the use of a graphic user interface in a wireless
communication device.

## II. DESCRIPTION OF THE RELATED ART

Wireless communication devices, such as cellular telephones, are widely
used as a replacement for conventional telephone systems. In addition to
functioning as a replacement for a conventional telephone, wireless
communication devices may be used for voice mail retrieval and text message
retrieval and display. These wireless communication devices, sometimes
known as personal communication systems (PCS) use an alphanumeric display
to display retrieved text messages.

The wireless communication device typically includes a storage area to
permit user entry of destination telephone numbers. The storage area,
sometimes known as a speed dialing storage area, typically stores the user-
entered destination telephone number and a corresponding name. For example,
the user may enter the name of an individual or an identifier such as "HOME"
along with the user's home telephone number. The user-entered destination
telephone numbers may be stored in individual speed dial locations and are
used by recalling the destination telephone number from a specific location.
Alternatively, the wireless communication device may display the name and
destination telephone number of the first speed dial location and include
control buttons to scroll through the list of stored destination telephone
numbers. When the desired destination telephone number is scrolled onto the
display, the user may select it.

Such alphanumeric text displays provide limited information to the user
and must be displayed in a fixed-text format on the display. However, such
fixed-text formats cannot be used to provide different font displays or graphical
data. Therefore, it can be appreciated that there is a significant need for a
graphic user interface in a wireless communication device to provide a variety
of graphic formats that are not limited to the individual alphanumeric

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characters. The present invention provides this and other advantages as will be illustrated by the following description and accompanying figures.

## SUMMARY OF THE INVENTION

The present invention is directed to a system for the use of graphical data in a wireless communication device. In an exemplary embodiment, the system includes a two-dimensional display, a first data structure to store data for graphic images representing a plurality of caller destinations with at least a portion of the graphic images being shown on the display, and a second data structure containing destination telephone numbers corresponding to respective ones of the plurality of caller destinations. The system also includes a user input device to sense user selection of one of the graphic images on the display and a data indicator, responsive to the user input device, to select the destination telephone number corresponding to the caller destination represented by the selected graphic image on the display.

The system also typically includes a transceiver to communicate with a communication device remote from the system. The transceiver transmits the selected destination telephone number. In one embodiment, the first data structure is preprogrammed with graphic data representing the plurality of caller destinations. Alternatively, the system may further include an interface device coupleable to an external data source to receive graphic data. The first data structure stores the graphic data representing the plurality of caller destinations received from the external data source.

The user input device can also be used to enter a selected destination telephone number, which may be associated with a selected caller destination and a selected one of the graphic images representing the selected caller destination.

The system may also automatically store a predetermined number of previously called destination telephone numbers. The display, in this embodiment, displays graphic images representing the caller destinations corresponding to at least a portion of the predetermined number of previously called destination telephone numbers. The user may select one of the previously called destination telephone numbers by selecting one of the displayed graphic images. The second data structure may store the previously called destination telephone numbers in a manner indicative of the sequence in which the numbers were previously called so that the display displays graphic images in a manner indicative of the sequence in which the predetermined number of previously called destination telephone numbers were called. The

graphic images may be displayed in a sequence indicative of the sequence in which the predetermined number of previously called destination telephone numbers were called. Alternatively, the graphic images may be scaled in size so that the image size corresponds to the sequence in which the predetermined

5    number of previously called destination telephone numbers were called. In yet another alternative embodiment, the system may display graphic images in the form of partially overlapping windows that are displayed in a sequence corresponding to the sequence in which the predetermined number of previously called destination telephone numbers were called.

10    In another alternative embodiment, the second data structure may store the predetermined number of previously called destination telephone numbers in a manner indicative of a frequency with which the predetermined number of previously called destination telephone numbers were called. In this embodiment, the display displays graphic images representing caller

15    destinations corresponding to at least a portion of the predetermined number of previously called destination telephone numbers in a manner indicative of the frequency with which the predetermined number of previously called destination telephone numbers were called. The graphic images may be displayed in a sequence corresponding to the frequency with which the

20    predetermined number of previously called destination telephone numbers were called. Alternatively, the display can display the graphic images with an image size corresponding to the frequency with which the predetermined number of previously called destination telephone numbers were called. In yet another alternative embodiment, the graphic images may be displayed as a

25    series of partially overlapping display windows that are displayed in a sequence corresponding to the frequency with which the predetermined number of previously called destination telephone numbers were called.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a functional block diagram of the wireless communication

30    device of the present invention.

FIG. 2 is a fragmentary enlarged view of the display of the wireless communication device of FIG. 1.

FIG. 3 is an example of the display used by the system of FIG. 1 to display graphic images.

35    FIG. 4 is an example of the screen display of the system of FIG. 1 to display graphic images.

FIG. 5A is an alternative embodiment of the display of the system of FIG. 1 to display graphic images.

FIG. 5B illustrates the display of FIG. 5A with graphic images scrolled into new display positions.

FIG. 6A illustrates the use of the display of the system of FIG. 1 to display call history patterns.

FIG. 6B illustrates the display of the system of FIG. 1 in an alternative display of call history patterns.

FIG. 6C illustrates the display of the system of FIG. 1 in an alternative display of call history patterns.

FIG. 7A is another alternative embodiment of FIG. 1 in an alternative display of call history patterns.

FIG. 7B illustrates the display of the system of FIG. 1 with a different call history data display window scrolled into position.

FIG. 7C illustrates the display of the system of FIG. 1 with a different call history data display window scrolled into position.

FIG. 8 is a flowchart illustrating the operation of the system of FIG. 1 to enter and associate data with a graphic image.

FIG. 9 is a flowchart of the operation of the system of FIG. 1 to select a destination telephone number based on the selection of a graphic image.

## DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The conventional wireless communication device has a display designed for the display of individual alphanumeric text characters. For example, the user may program the wireless communication device to store a plurality of frequently called numbers in a storage location sometimes known as a speed dial storage location. A particular wireless communication device may allocate a portion of memory for the storage of, by way of example, ten different telephone numbers. The user programs the speed dial storage location with alphanumeric text, such as "HOME" along with the telephone number corresponding to the user's home. Similarly, other numbers and associated names may be entered into the remaining speed dial storage locations.

The user of the wireless communication device may recall a selected one of the speed dial storage locations by pressing a "recall" button and a speed dial location number (*e.g.*, 1 to 10). The recalled name and associated destination telephone number are shown on the display.

In contrast, the present invention is directed to the use of graphic images or icons to display information to the user. The use of graphical information can be readily understood and interpreted by the user at a glance without the need for reading the individual characters on the conventional alphanumeric

5    text display. The present invention is embodied in a system 100 illustrated in the functional block diagram of FIG. 1. The system 100 includes a central processing unit (CPU) 102, which controls operation of the system. A memory 104, which may include both read-only memory (ROM) and random access memory (RAM), provides instructions and data to the CPU 102. A portion of

10   the memory 104 may also include non-volatile random access memory. As will be discussed in greater detail below, the non-volatile random access memory portion of the memory 104 may be used to store graphic images.

The system 100, which is typically embodied in a wireless communication device such as a cellular telephone, also includes a housing 106

15   that contains a transmitter 108 and a receiver 110 to allow transmission and reception of data, such as audio communications, between the system 100 and a remote location, such as a cell site controller (not shown). The transmitter 108 and receiver 110 may be combined into a transceiver 112. An antenna 114 is attached to the housing 106 and electrically coupled to the transceiver 112. The

20   operation of the transmitter 108, receiver 110, and antenna 114 is well known in the art and need not be described herein.

A keypad 118 is attached to the housing 106 for operation by the user in a conventional manner. As will be described below, the keypad 118 provides a convenient input device by which destination telephone numbers may be

25   entered by the user. The keypad 118 also includes one or more scroll buttons 120 (see FIG. 3) that allow the user to sequentially move through the stored graphic images.

The system 100 also includes a display memory 122 and a display 124. The display memory 122 is coupled to the display 124 and contains data for the

30   display 124. The display memory contains data representing one or more bitmap images to be displayed on the display 124. The display memory 122 may be a separate storage area or may be a portion of the memory 104. As will be discussed in detail below, the system 100 processes graphic data as a bitmap image rather than process individual characters as is done with alphanumeric

35   text in the conventional wireless communication device.

In an exemplary embodiment, the display 124 is a two-dimensional array having 128 pixels in a first dimension and 64 pixels in a second dimension orthogonal to the first dimension. If the display 124 is a monochrome display,

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the 128 x 64 pixel array results in an 8,192 bit bitmap, with a one-to-one correspondence between data bits in the bitmap image stored in the display memory 122 and pixels in the display 124. A bitmap for the entire 8,192 pixel array of the display 124 can be stored in the display memory using a maximum

5   of 1,024 (1 K) bytes. As can be readily appreciated by those skilled in the art, multiple data bits in the bitmap are required for each pixel of the display 124 if the display is a color display.

A data storage area 126 is used to store the graphic image data and destination telephone numbers for the system 100. In one embodiment, certain

10  graphic images may be preprogrammed into the system 100. For example, graphic images for common destination telephone numbers such as a home, office, automobile, facsimile machine, and the like may be preprogrammed as graphic bitmap images and stored within the data storage area 126. In this embodiment, the programmed graphic bitmap images may be stored in the

15  ROM portion of the memory 104. While illustrated as a conventional memory, it can be appreciated by those skilled in the art that the data storage area 126 can be any form of a data structure.

The user-entered data, such as desired destination telephone numbers, are entered into the system 100 using the keypad 118 and are stored in a

20  telephone number storage area 128. The telephone number storage area 128 may be included in the non-volatile memory portion of the memory 104 or may be a separate storage area. As can be appreciated by those skilled in the art, the telephone number storage area 128 may be any suitable data structure. The user-entered destination telephone numbers are stored in the telephone number

25  storage area 128 in association with the graphic images stored in the data storage area 126. As will be described in greater detail below, the user selects the desired destination telephone number from the telephone number storage area 128 by selecting the associated graphic image shown on the display 124. When the user selects a graphic image on the display 124, a data selection

30  indicator 130 is used to identify the associated destination telephone number in the telephone number storage area 128.

In an alternative embodiment, the user may download graphic images via an input connector 132 on an input interface 134. The input interface 134 may be any convenient hardware interface, such as a serial interface. However,

35  those skilled in the art will recognize that any conventional interface will operate satisfactorily with the system 100. Accordingly, the present invention is not limited by the specific form of the input interface 134.

In yet another alternative embodiment, the user may download graphic images over the air using the receiver **110**. Over-the-air programming techniques are known in the art and need not be described in great detail herein. However, the graphic images are transmitted to the system **100**, received by the receiver **110**, and stored in the data storage area **126**.

The graphic image data, whether preprogrammed, downloaded over the air, or downloaded via the input interface **134**, is stored in the data storage area **126**. To reduce the storage requirements of the data storage area **126**, the system **100** includes an optional data compression processor **140**. Compression of the data prior to storage greatly reduces the storage capacity requirements of the data storage area **126**. A number of well known data compression techniques may be implemented by the data compression processor **140**. For example, run length encoding, LZ compression, MR compression, MMR compression, or the like may be satisfactorily used with the system **100**. The present invention is not limited by the specific form of the data compression used to compress data for storage in the data storage area **126**.

For the sake of clarity, the data compression processor **140** is illustrated in FIG. 1 as a separate functional block. However, those of ordinary skill in the art will appreciate that the function of the data compression processor **140** may be performed by the CPU **102** executing instructions from the memory **104**. For example, a subroutine may be executed by the CPU **102** to perform the steps of data compression while a separate subroutine may be executed by the CPU to expand the compressed data. The operation of the CPU **102** to perform the function of the data compression processor **140** is well known in the art and will not be described in detail herein.

The system **100** also includes a dialed digits storage area **144** to temporarily store the destination telephone number. The dialed digits storage area **144** receives data entered by the user via the keypad **118** if the user is manually entering the desired destination telephone number. However, the system **100** will automatically enter the destination telephone number selected from the telephone number storage area **128** into the dialed digits storage area **144** in response to the user selection one of the graphic images on the display **124**.

When the user selects a graphic image shown on the display **124**, the associated telephone number in the telephone number storage area **128** is transferred to the dialed digits storage area **144**. In operation, the transmitter **108** transmits the data in the dialed digits storage area **144** to initiate a telephone

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call to the destination telephone whose telephone number is stored in the dialed digits storage area.

A call history storage area 146 stores a predetermined number of previously dialed destination telephone numbers. Call history storage area 146 may also be used to store those telephone numbers from which a call was received, i.e., "called from" numbers. "Called from" numbers may be regarded as destination telephone numbers. For example, the call history storage area 146 may store the destination telephone numbers from the last ten phone calls. The data in the dialed digits storage area 144 may be transferred to the call history storage area when a telephone call is initiated. The call history storage area 146 is conveniently used to recall previously dialed telephone numbers. The use of graphic images in the call history storage area 146 will be discussed in greater detail below.

The various components described above are powered by a battery 148. In an exemplary embodiment, the battery 148 is a rechargeable battery. Alternatively, the system 100 may be powered by an external source, such as an AC adapter (not shown), an automobile power supply adapter (not shown), or the like.

The various components of the system 100 are coupled together by a bus system 150, which may include a power bus, control signal bus, and status signal bus in addition to a data bus. However, for the sake of clarity, the various buses are illustrated in FIG. 1 as the bus system 150.

The operation of the system 100 may now be explained in greater detail. The system 100 differs from the conventional wireless communication device in that at least a portion of the display 124 is used to display graphic images. In an exemplary embodiment, the graphic images are stored in the data storage area 126 in the form of bitmap images. As described above, the bitmap image in the data storage area 126 may be in a compressed form. The use of bitmap image data in the system 100 permits the use of graphic images as well as offering other data processing advantages. For example, bitmap images may be readily processed by the CPU 102 with relatively few instructions.

The display 124 is shown in greater detail in FIG. 2. As discussed above, the display 124 comprises a two-dimensional array of pixels that may be conveniently organized into rows and columns. In an exemplary embodiment, the display 124 comprises a two-dimensional array having 128 columns and 64 rows to correspond with the 128 x 64 pixel array discussed above. The location of a particular pixel may be identified using an (X, Y) coordinate system corresponding to the column and row, respectively, in the display 124.

Each data bit in the display memory 122 corresponds to a single pixel for the monochrome version of the display 124. The pixel is active (*i.e.*, is visible) when the corresponding bit in the bitmap data has a first logic level and is inactive (*i.e.*, invisible) when the corresponding bit in the bitmap has a second opposite logic level. If the display 124 is a color display, multiple data bits in the display memory 122 are used for each pixel. For example, eight data bits per pixel can be used to provide 256 different colors for each pixel in the display 124.

The operation of the system 100 may now be described in greater detail. In an exemplary embodiment, shown in FIG. 3, the display 124 includes a house graphic image 160, a work building graphic image 162, and an automobile graphic image 164. A home destination telephone number 168 associated with the house graphic image 160 is also displayed. Similarly, a work destination telephone number 170 and an automobile destination telephone number 172 are displayed in association with the work building graphic image 162 and the automobile graphic image 164, respectively. Additional graphic images may be stored in the data storage area 126 (see FIG. 1) but cannot be displayed due to size limitations of the display 124. The scroll buttons 120 may be used to scroll through the data storage area 126 in the desired direction to display additional graphic images.

In an alternative embodiment, illustrated in FIG. 4, the display 124 includes a "HOME" label 174, a "WORK" label 176 and a "CAR PHONE" label 178 associated with the house graphic image 160, the work building graphic image 162, and the automobile graphic image 164, respectively. Thus, the HOME label 174 may be used in place of the home destination telephone number 168 (see FIG. 3).

In yet another alternative embodiment, illustrated in FIG. 5A, the display 124 includes no alphanumeric text labels. Instead, the display 124 includes only the house graphic image 160, the work building graphic image 162, and the automobile graphic image 164. The user selects the desired destination telephone number by selecting one of the displayed images. The user may activate the scroll buttons 120 to display additional images, as illustrated in FIG. 5B, where the scroll button 120 was activated to display a facsimile telephone number graphic image 182.

In an exemplary embodiment, the graphic image at the top of the display may be highlighted in any convenient manner to indicate that it is the selected graphic image. For example, in FIG. 5A, a selection indicator 184, such as an asterisk, is positioned near the house graphic image 160 at the top of the display

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124 to indicate the selection of the house graphic image. Accordingly, the system 100 will select the home destination telephone number associated with the house graphic image 160 from the telephone number storage area 128 (see FIG. 1) and transfer the destination telephone number to the dialed digits storage area 144. In FIG. 5B, the scroll buttons 120 have been activated to move the graphic images so that the selection indicator 184 is positioned near the work building graphic image 162 at the top of the display 124. Thus, the work building graphic image 162 will be selected. The destination telephone number associated with the work building graphic image 162 is extracted from the telephone number storage area 128 and stored in the dialed digits storage area 144. Other forms of the selection indicator, such as reverse video or other highlighting, may be used with the system 100. Alternatively, the scrolling buttons 120 may be used to reposition the selection indicator 184 such that the selection indicator is scrolled rather than the graphic images. In this embodiment, the graphic image positioned next to the selection indicator 184 is selected by the system 100.

In another alternative embodiment, the display 124 may be a touch-sensitive display. In this embodiment, the user simply touches the display 124 at the desired graphic image to indicate his selection. The display 124 may be touched by the user's finger or by a stylus (not shown). For example, the user can select the automobile destination telephone number simply by touching the automobile graphic image 164. The graphic images illustrated in FIGS. 5A and 5B may be more widely distributed on the display 124 to assist the user in touching a single graphic image without inadvertently touching the wrong graphic image. The operation of touch-sensitive screens is well-known and need not be described in greater detail herein.

When the desired graphic image has been selected, the associated telephone number is extracted from the telephone number storage area 128 by the CPU 102 and placed in the dialed digits storage area 144. As is known in the art, the transmitter 108 is activated to transmit the data in the dialed digits storage area 144 to establish a wireless communications channel between the system 100 and the communication device associated with the dialed digits. For example, the user depresses the "SEND" button (not shown), which causes the transmitter 108 to transmit the data in the dialed digits storage area 144.

The system 100 also stores the dialed digits in the call history storage area 146 (see FIG. 1) to maintain a historic calling record. For example, the wireless communication device may store, by way of example, the last ten telephone numbers called by the system 100. In the conventional wireless

communication device, the call history is stored in the form of alphanumeric text characters indicating the last ten telephone numbers contacted by the wireless communication device. In contrast, the system 100 can store historic call data in the form of graphic images. For example, the system 100 can

5      provide a graphic indication of the destination telephone numbers for the last ten calls. In FIG. 6A, the house graphic image 160 is shown at the top of the display 124 to indicate that the home destination telephone number was the last number called. The graphic images can indicate the number of times in the past ten telephone calls that a particular number was called. This is also illustrated

10     in FIG. 6A where the work building graphic image 162 is enlarged to indicate that the work destination telephone number was called more frequently than the home destination telephone number. The enlarged work building graphic image 162 allows the user to determine, at a glance, which number was more frequently called. The user can select the destination telephone number

15     associated with the graphic images by positioning the desired graphic image near the selection indicator 184. In FIG. 6A, the house graphic image 160 is positioned near the selection indicator 184 thus indicating that the system 100 will use the home destination telephone number associated with the house graphic image 160. The user can manipulate the scroll buttons 120 to position

20     the work building graphic image 162 near the selection indicator 184 if the user wishes to call the work destination telephone number. As previously discussed, the display 124 may be a touch-sensitive display in which the user simply presses the desired graphic image. The enlarged work building graphic image 162 in FIG. 6A makes it easier to select the work destination telephone number

25     using a touch-sensitive screen.

In an alternative embodiment, illustrated in FIG. 6B, the display 124 shows the graphic images in the order of frequency of use rather than in a chronological order. In this example, the work building graphic image 162 is positioned at the top of the display 124 to indicate that it is the most frequently

30     called number of the last ten telephone numbers in the call history storage area 146 (see FIG. 1). The position of the house graphic image 160 below the work building graphic image 162 indicates that the home destination telephone number was the next most frequently called telephone number. The work building graphic image 162 is positioned near the selection indicator 184. The

35     user may call the work destination telephone number simply by activating the system 100 or it may use the scroll buttons 120 in the manner described above to position the house graphic image 160 near the selection indicator 184 to call the home destination telephone number.

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In yet another alternative embodiment, illustrated in FIG. 6C, the display 124 may show the enlarged work building graphic image 162 to indicate the relative frequency of the last number of calls to the work destination telephone number as well as the indication that the work destination telephone number

5  was the last number called by the system 100. The smaller house graphic image 160 located below the enlarged work building graphic image 162 is indicative of the relative number of calls placed to the home destination telephone number as compared to the number of calls placed to the work destination telephone number. The user may select the desired destination telephone number by

10  manipulating the scroll buttons 120 to place the desired graphic image in position near the selection indicator 184 or by touching the desired portion of the display 124 if the display includes a touch-sensitive screen.

In yet another alternative embodiment, the system 100 displays the data in the call history storage area 146 using a series of overlapping display

15  windows 190. In FIG. 7A, the top window 190 contains the house graphic image 160 thus indicating that the home destination telephone number was the last number called. The user can activate the scroll buttons 120 in a manner previously described to display the next sequential window 190. For example, in FIG. 7B, the work building graphic image 162 is displayed in the top window

20  190. The user may select the desired destination telephone number based on call history by manipulating the scroll buttons 120 to place the desired graphic image in the top window 190. In the example of FIG. 7A, the home destination telephone number would be used by the system 100, while in FIG. 7B, the work destination telephone number would be used by the system.

25  In an alternative embodiment, illustrated in FIG. 7C, the display 124 may include additional data, such as the work destination telephone number 170 or the work label 176 in addition to the work building graphic image 162. Other variations, such as enlarged graphic images may be used to indicate the frequency with which a particular destination telephone number has been

30  called. In addition, the windows 190 may be arranged such that the most frequently called number appears in the top window 190.

The system 100 described thus far includes preprogrammed graphic images that are stored in the data storage area 126. However, the system 100 may optionally include the input interface 134. By connecting an external

35  device, such as a computer (not shown), to the input connector 132, it is possible to download a graphic image into the system 100. The user readily recognizes the graphic images thus simplifying operation of the system 100. This is particularly advantageous for downloading digitized images such as an actual

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picture of the user's home, the user's office building, the user's automobile, and the like. Similarly, the user may download actual digitized photographs of individuals such as the user's spouse, business associates, and the like. Alternatively, the user may download other customized graphic images for storage in the data storage area 126. Graphic images such as digitized photographs generally have a significantly higher resolution than can be provided by the system 100. However, conventional techniques are known to scale the resolution of the graphic image to match the resolution of the display 124. Such well-known scaling techniques need not be described herein. The advantage of downloaded graphic images is that the user of the system 100 readily recognizes the graphic image associated with the desired destination telephone number, thus simplifying the calling process.

The operation of the system 100 is illustrated in the flowchart of FIG. 8 where, at a start 200, the system 100 is under power. In step 202, the system 100 may optionally download a user-entered graphic image using the input interface 134 in the manner previously described. In step 204, the data compression processor 140 compresses the bitmap image and in step 206, the compressed bitmap image is stored in the data storage area 126. As previously discussed, at least a portion of the data storage are 126 must be capable of receiving and storing the downloaded graphic image and therefore may be, by way of example, non-volatile RAM.

In step 210, the user selects the desired graphic image for programming. The desired graphic image may be selected in the manner previously described, such as activating the scroll buttons 120 to move the desired graphic image in position near the selection indicator 184. In step 212, the user enters the desired destination telephone number to be associated with the selected graphic image. In step 216, the system 100 stores the user-entered telephone number in the telephone number storage area 128 in association with the selected graphic image and ends the process at 220. The user may repeat the process to enter additional destination telephone numbers in association with other graphic images. At the end of the programming process, a plurality of graphic images may be defined and associated with user-entered destination telephone numbers.

The operation of the system 100 to place a call using the graphical display system is illustrated in the flowchart of FIG. 9 where at a start 230 the system is under power. In step 232, the system 100 displays the graphic image list on the display 124. In step 234, the user selects the desired graphic image by manipulating the scroll buttons 120 (see FIGS. 3-7C) or touching a touch-

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sensitive screen in the manner previously described. When the user has selected the desired graphic image, the system 100 places the destination telephone number associated with the selected graphic image in the dialed digits storage area 144 (see FIG. 1) in step 236. In step 240, the user activates the

5    system to initiate a call to the destination telephone number stored in the dialed digits storage area. In step 242, the system 100 stores the telephone number and the associated graphic image in the call history storage area 146 (see FIG. 1) as previously described. The system ends the call process at step 244. Thus, the use of graphic images greatly enhances the user's ability to operate the wireless

10   communication device by providing readily recognizable graphic images to select the desired destination telephone number.

It is to be understood that even though various embodiments and advantages of the present invention have been set forth in the foregoing description, the above disclosure is illustrative only, and changes may be made

15   in detail, yet remain within the broad principles of the invention. Therefore, the present invention is to be limited only by the appended claims.


What is claimed is:

## CLAIMS

1.      A system for the use of graphical data in a wireless
communication device, the system comprising:

a transceiver to communicate with a communication device remote from
the system;

an antenna coupled to the transceiver;

a battery to provide electrical power to the system;

a display comprising a plurality of pixels arranged with a first
predetermined number of pixels in a first dimension and a second
predetermined number of pixels in a second dimension to form a two
dimensional display area;

a bitmap image data structure containing data for graphic images
representing a plurality of caller destinations, with at least a portion of the
graphic images being shown on the display;

a data structure containing destination telephone numbers
corresponding to respective ones of the plurality of caller destinations;

a user input device to sense user selection of one of the graphic images
on the display; and

a data indicator, responsive to the user input device, to select the
destination telephone number corresponding to the caller destination
represented by the selected graphic image on the display, the transceiver
transmitting the selected destination telephone number.

2.      The system of claim 1 wherein the bitmap image data structure is
preprogrammed with graphic data representing the plurality of caller
destinations.

3.      The system of claim 1, further comprising an interface device
coupleable to an external data source to receive graphic data therefrom, the
bitmap image data structure storing the graphic data representing the plurality
of caller destinations received from the external data source.

4.      The system of claim 1 wherein the user input device is further
used to enter a selected destination telephone number corresponding to a
selected caller destination, the data structure storing the user-entered
destination telephone numbers in association with a selected one of the graphic
images representing the selected caller destination.

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5.     The system of claim 1 wherein the data structure automatically
stores a predetermined number of previously called destination telephone
numbers, the display displaying graphic images representing caller destinations
corresponding to at least a portion of the predetermined number of previously
called destination telephone numbers to permit user selection of a selected one
of the previously called destination telephone numbers by selecting one of the
displayed graphic images.

6.     The system of claim 5 wherein the data structure stores the
predetermined number of previously called destination telephone numbers in a
manner indicative of the sequence in which the predetermined number of
previously called destination telephone numbers were called and the display
displays graphic images representing caller destinations corresponding to at
least a portion of the predetermined number of previously called destination
telephone numbers in a manner indicative of the sequence in which the
predetermined number of previously called destination telephone numbers
were called.

7.     The system of claim 6 wherein the display displays graphic
images representing caller destinations corresponding to the predetermined
number of previously called destination telephone numbers in a sequence
corresponding to the sequence in which the predetermined number of
previously called destination telephone numbers were called.

8.     The system of claim 6 wherein the display displays graphic
images representing caller destinations corresponding to the predetermined
number of previously called destination telephone numbers with an image size
corresponding to the sequence in which the predetermined number of
previously called destination telephone numbers were called.

9.     The system of claim 6 wherein the display displays graphic
images representing caller destinations corresponding to the predetermined
number of previously called destination telephone numbers as a series of
partially overlapping display windows displayed in a sequence corresponding
to the sequence in which the predetermined number of previously called
destination telephone numbers were called.

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10.    The system of claim 5 wherein the data structure stores the
2    predetermined number of previously called destination telephone numbers in a
manner indicative of a frequency with which the predetermined number of
4    previously called destination telephone numbers were called and the display
displays graphic images representing caller destinations corresponding to at
6    least a portion of the predetermined number of previously called destination
telephone numbers in a manner indicative of the frequency with which the
8    predetermined number of previously called destination telephone numbers
were called.

11.    The system of claim 10 wherein the display displays graphic
2    images representing caller destinations corresponding to the predetermined
number of previously called destination telephone numbers in a sequence
4    corresponding to the frequency with which the predetermined number of
previously called destination telephone numbers were called.

12.    The system of claim 10 wherein the display displays graphic
2    images representing caller destinations corresponding to the predetermined
number of previously called destination telephone numbers with an image size
4    corresponding to the frequency with which the predetermined number of
previously called destination telephone numbers were called.

13.    The system of claim 10 wherein the display displays graphic
2    images representing caller destinations corresponding to the predetermined
number of previously called destination telephone numbers as a series of
4    partially overlapping display windows displayed in a sequence corresponding
to the frequency with which the predetermined number of previously called
6    destination telephone numbers were called.

14.    The system of claim 1 wherein graphic data representing only a
2    portion of the plurality of caller destinations are shown on the display, the
system further including a scroll control element operable by a user to alter the
4    data on the display to thereby display additional ones of the plurality of caller
destinations.

15.    The system of claim 1 wherein the display is a monochrome
2    display and the graphic data in the bitmap image data structure includes a

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single bit for each pixel in the display used to display graphic data representing

4    each of the plurality of caller destinations shown on the display.


16.    The system of claim 1 wherein the display is a color display and

2    the graphic data in the bitmap image data structure includes multiple data bits

for each pixel in the display used to display graphic data representing each of

4    the plurality of caller destinations shown on the display.


17.    The system of claim 1 wherein the graphic data in the bitmap

2    image data structure is stored in compressed form, the system further including

a compression processor to process the compressed graphic data to generate the

4    graphic data to be shown on the display.


18.    A system for the use of graphical data in a wireless

2    communication device, the system comprising:

a first data structure to store user-entered destination telephone

4    numbers;

a two dimensional display;

6    a second data structure containing image data for graphic images

associated with respective user-entered destination telephone numbers, with at

8    least a portion of the graphic images being shown on the display;

a user input device to permit user entry of destination telephone

10   numbers and to select one of the displayed graphic images; and

a data indicator, responsive to the user input device, to select the

12   destination telephone number associated with the selected graphic image, the

selected destination telephone number being used to establish communication

14   with the communication device associated with the selected destination

telephone number.


19.    The system of claim 18, further comprising a transceiver to

2    communicate with the communication device associated with the selected

destination telephone number, the transceiver transmitting the selected

4    destination telephone number.


20.    The system of claim 18 wherein the image data is preprogrammed

2    in the second data structure and associated with user-entered destination

telephone numbers when entered by the user.

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21. The system of claim 18, further comprising an interface device
2 coupleable to an external data source to receive image data therefrom, the
second data structure storing the image received from the external data source
4 in association with respective user-entered destination telephone numbers.

22. The system of claim 18, further comprising a receiver to receive
2 image data transmitted over the air, the second data structure storing the image
data received by the receiver.

23. A method for the use of graphical data in a wireless
2 communication device, the method comprising the steps of:
storing bitmap image data for graphic images representing a plurality of
4 caller destinations;
displaying at least a portion of the graphic images on a display;
6 storing destination telephone numbers corresponding to respective ones
of the plurality of caller destinations;
8 sensing user selection of one of the graphic images on the display;
selecting the destination telephone number corresponding to the caller
10 destination represented by the selected graphic image on the display; and
transmitting the selected destination telephone number to establish a
12 communication link between the wireless communication device and a
communication device corresponding to the selected destination telephone
14 number.

24. The method of claim 23 wherein the step of storing bitmap image
2 data for graphic images representing a plurality of caller destinations is
performed at the time of manufacture of the wireless communication device.

25. The method of claim 23, further comprising the step of receiving
2 graphic data from an external data source, the step of storing bitmap image data
for graphic images representing a plurality of caller destinations storing the
4 graphic data representing the plurality of caller destinations received from the
external data source.

26. The method of claim 23, further comprising the step of sensing
2 user entry of a selected destination telephone number corresponding to a
selected caller destination, the step of storing destination telephone numbers

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4    storing the user-entered destination telephone numbers in association with a
     selected one of the graphic images representing the selected caller destination.

     27.    The method of claim 23, further comprising the step of
2    automatically storing a predetermined number of previously called destination
     telephone numbers, the step of displaying graphic images displaying graphic
4    images corresponding to at least a portion of the predetermined number of
     previously called destination telephone numbers, the step of sensing user
6    selection of one of the graphic images on the display sensing user selection of a
     selected one of the displayed graphic images corresponding to previously called
8    destination telephone numbers.

     28.    The method of claim 27 wherein the step of storing destination
2    telephone numbers stores the predetermined number of previously called
     destination telephone numbers in a manner indicative of the sequence in which
4    the predetermined number of previously called destination telephone numbers
     were called and the step of displaying displays graphic images representing
6    caller destinations corresponding to at least a portion of the predetermined      .
     number of previously called destination telephone numbers in a manner
8    indicative of the sequence in which the predetermined number of previously
     called destination telephone numbers were called.

     29.    The method of claim 28 wherein the step of displaying displays
2    graphic images representing caller destinations corresponding to the
     predetermined number of previously called destination telephone numbers in a
4    sequence corresponding to the sequence in which the predetermined number of
     previously called destination telephone numbers were called.

     30.    The method of claim 28 wherein the step of displaying displays
2    graphic images representing caller destinations corresponding to the
     predetermined number of previously called destination telephone numbers
4    with an image size corresponding to the sequence in which the predetermined
     number of previously called destination telephone numbers were called.

     31.    The method of claim 28 wherein the step of displaying displays
2    graphic images representing caller destinations corresponding to the
     predetermined number of previously called destination telephone numbers as a
4    series of partially overlapping display windows displayed in a sequence

corresponding to the sequence in which the predetermined number of
6    previously called destination telephone numbers were called.

32.    The method of claim 27 wherein the step of storing destination
2    telephone numbers stores the predetermined number of previously called
destination telephone numbers in a manner indicative of the frequency with
4    which the predetermined number of previously called destination telephone
numbers were called and the step of displaying displays graphic images
6    representing caller destinations corresponding to at least a portion of the
predetermined number of previously called destination telephone numbers in a
8    manner indicative of the frequency with which the predetermined number of
previously called destination telephone numbers were called.

33.    The method of claim 32 wherein the step of displaying displays
2    graphic images representing caller destinations corresponding to the
predetermined number of previously called destination telephone numbers in a
4    sequence corresponding to the frequency with which the predetermined
number of previously called destination telephone numbers were called.

34.    The method of claim 32 wherein the step of displaying displays
2    graphic images representing caller destinations corresponding to the
predetermined number of previously called destination telephone numbers
4    with an image size corresponding to the frequency with which the
predetermined number of previously called destination telephone numbers
6    were called.

35.    The method of claim 32 wherein the step of displaying displays
2    graphic images representing caller destinations corresponding to the
predetermined number of previously called destination telephone numbers as a
4    series of partially overlapping display windows displayed in a sequence
corresponding to the frequency with which the predetermined number of
6    previously called destination telephone numbers were called.

36.    The method of claim 23 wherein graphic data representing only a
2    portion of the plurality of caller destinations are shown on the display, the
method further comprising the steps of sensing user operation of a scroll control
4    element and altering the data on the display to thereby display additional ones
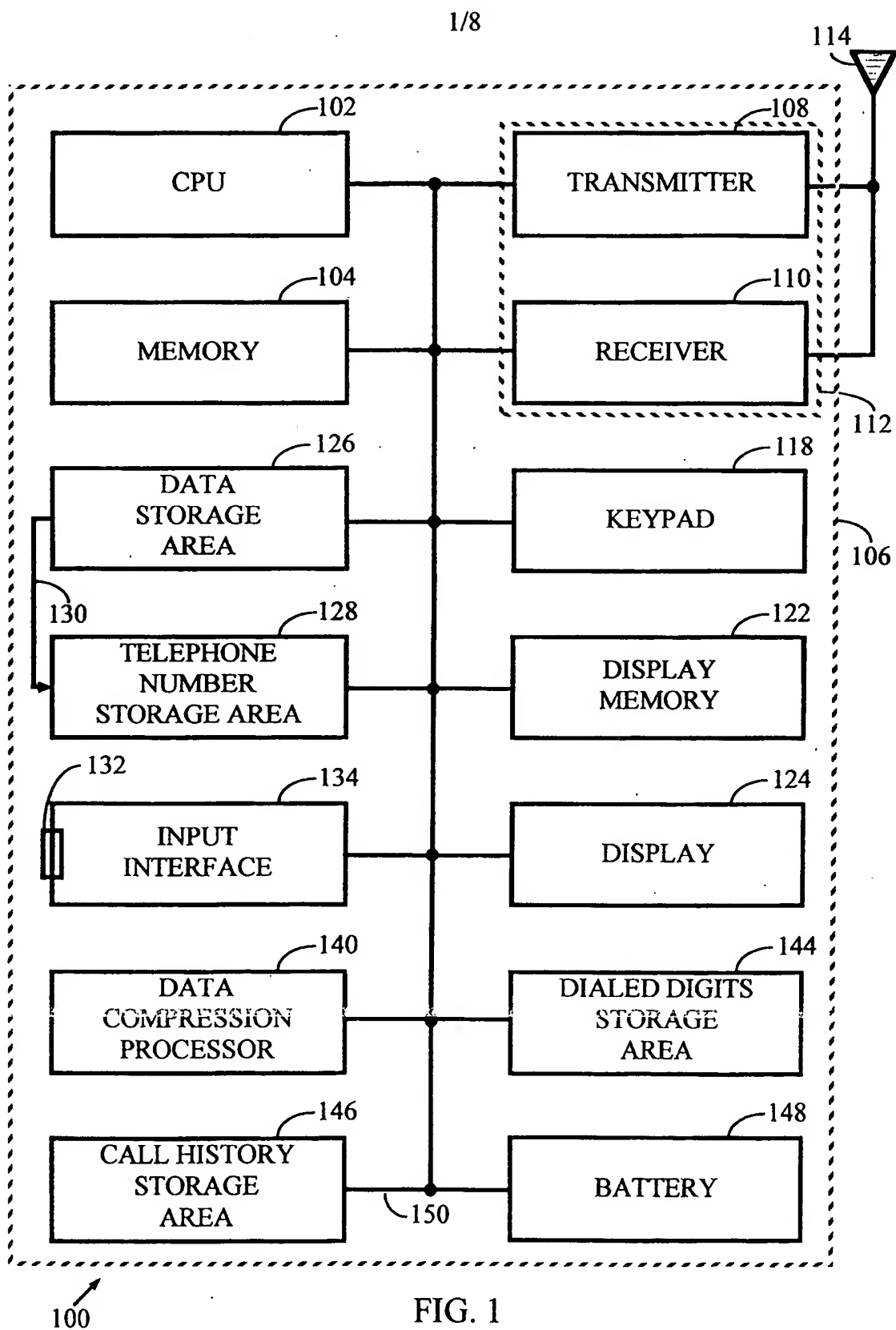of the plurality of caller destinations.

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37.     The method of claim 23 wherein the graphic data in the bitmap

2    image is stored in compressed form, the method further comprising the step of processing the compressed graphic data to generate the graphic data to be

4    shown on the display.


38.     A method for the use of graphical data in a wireless

2    communication device, the method comprising the steps of:
         storing image data for graphic images associated with respective user-

4    entered destination telephone numbers;
         sensing user entry of destination telephone numbers;

6    storing user-entered destination telephone numbers in association with the stored graphic images;

8         displaying at least a portion of the graphic images on a display;
         sensing user selection of one of the displayed graphic images; and

10        selecting the destination telephone number associated with the selected graphic image, the selected destination telephone number being used to

12    establish communication with the communication device associated with the selected destination telephone number.


39.     The method of claim 38, further comprising the step of

2    transmitting the selected destination telephone number.


40.     The method of claim 38 wherein the step of storing image data for

2    graphic images representing a plurality of caller destinations is performed at the time of manufacture of the wireless communication device.


41.     The method of claim 38, further comprising the step of receiving

2    graphic data from an external data source, the step of storing image data for graphic images representing a plurality of caller destinations storing the graphic

4    data representing the plurality of caller destinations received from the external data source.
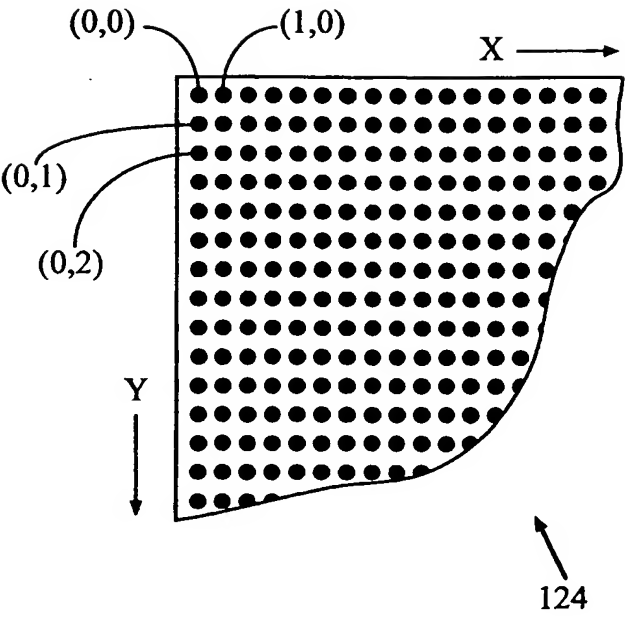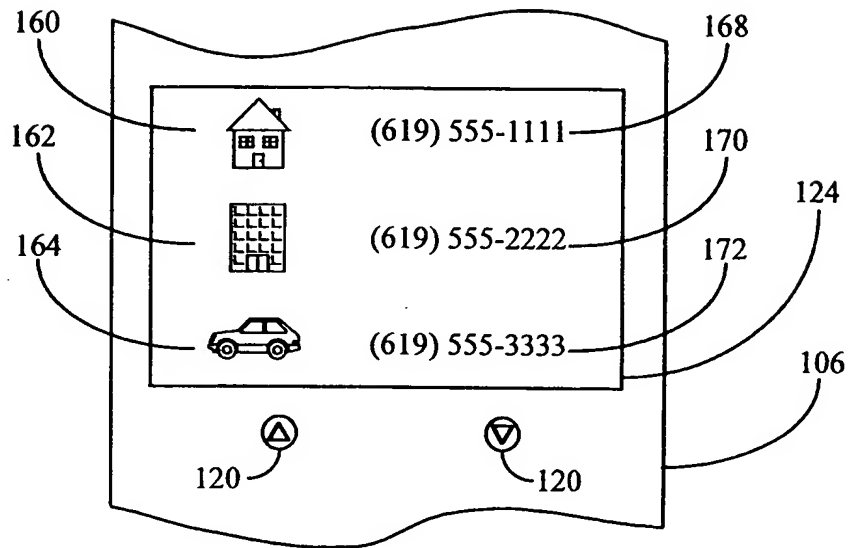
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114

CPU — 102

TRANSMITTER — 108

MEMORY — 104

RECEIVER — 110

112

DATA STORAGE AREA — 126

KEYPAD — 118

106

130

TELEPHONE NUMBER STORAGE AREA — 128

DISPLAY MEMORY — 122

132

INPUT INTERFACE — 134

DISPLAY — 124

DATA COMPRESSION PROCESSOR — 140

DIALED DIGITS STORAGE AREA — 144

CALL HISTORY STORAGE AREA — 146

BATTERY — 148

150

100

FIG. 1

FIG. 2

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160 168

162 170

124

164 172

106

(619) 555-1111

(619) 555-2222

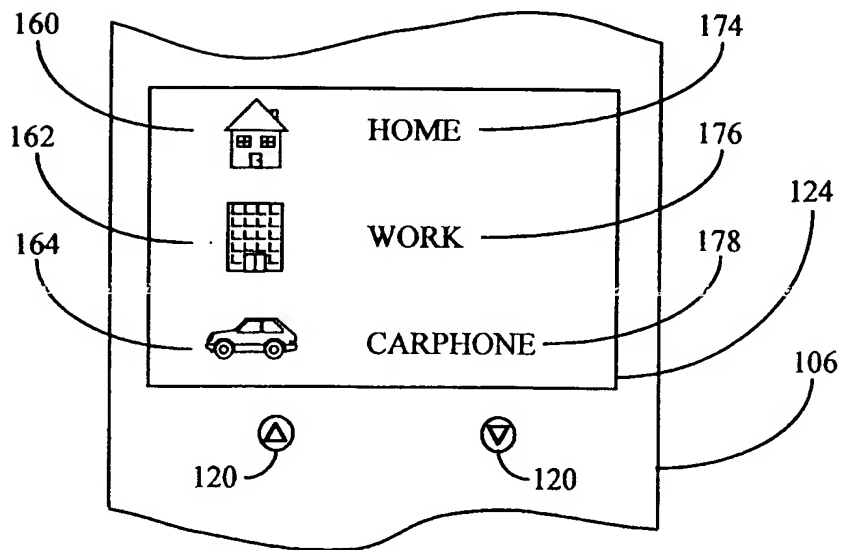(619) 555-3333

120 120

## FIG. 3

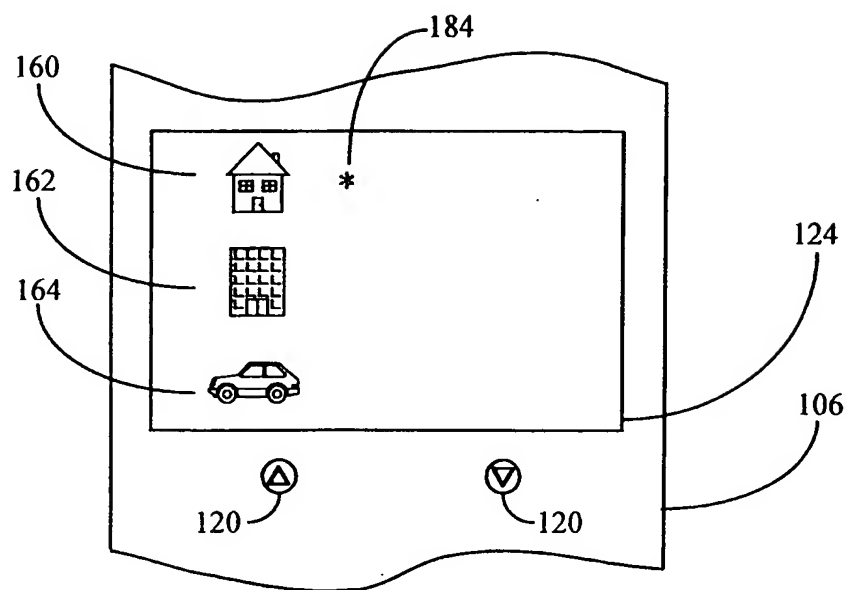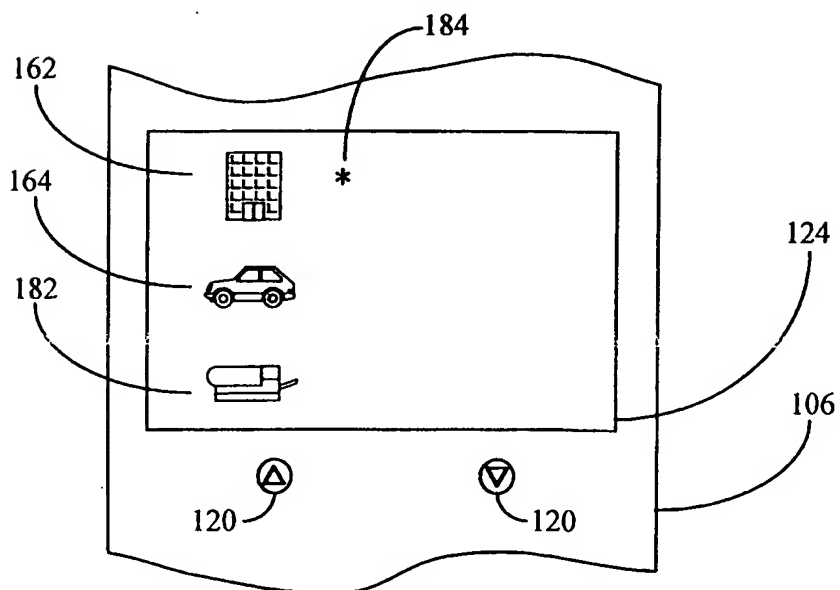160 174
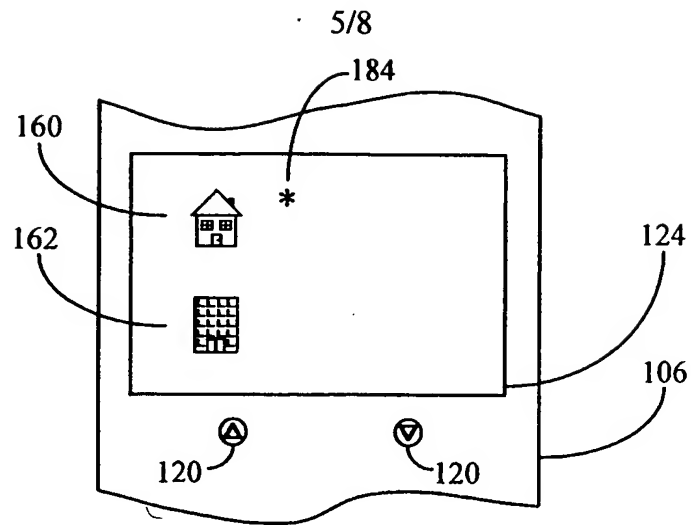
162 176

124

164 178

106
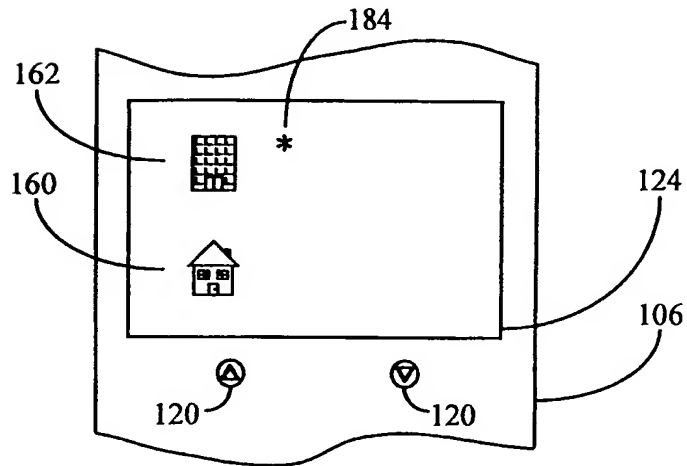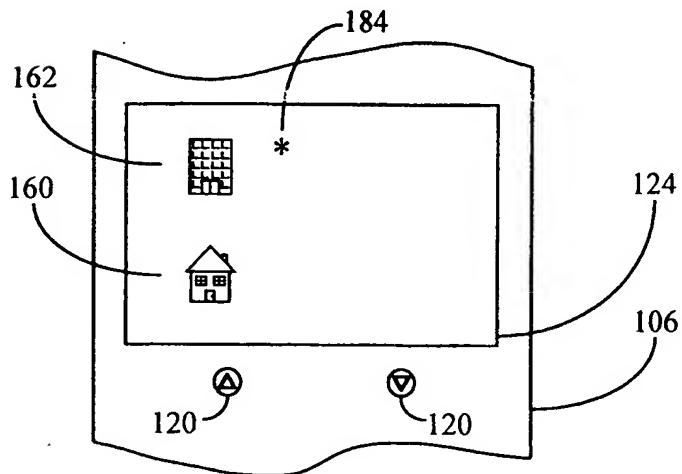
HOME

WORK

CARPHONE

120 120

## FIG. 4

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FIG. 5A

FIG. 5B

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FIG. 6A

FIG. 6B

FIG. 6C

FIG. 7A
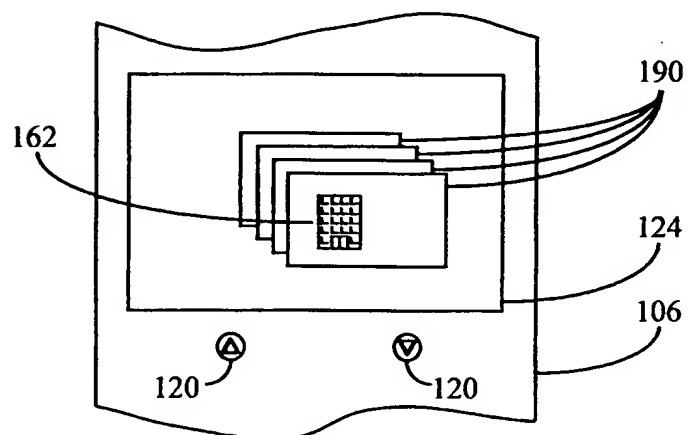


FIG. 7B
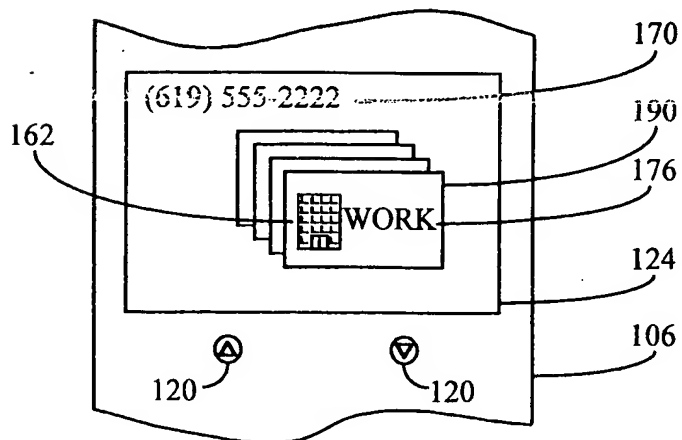


FIG. 7C

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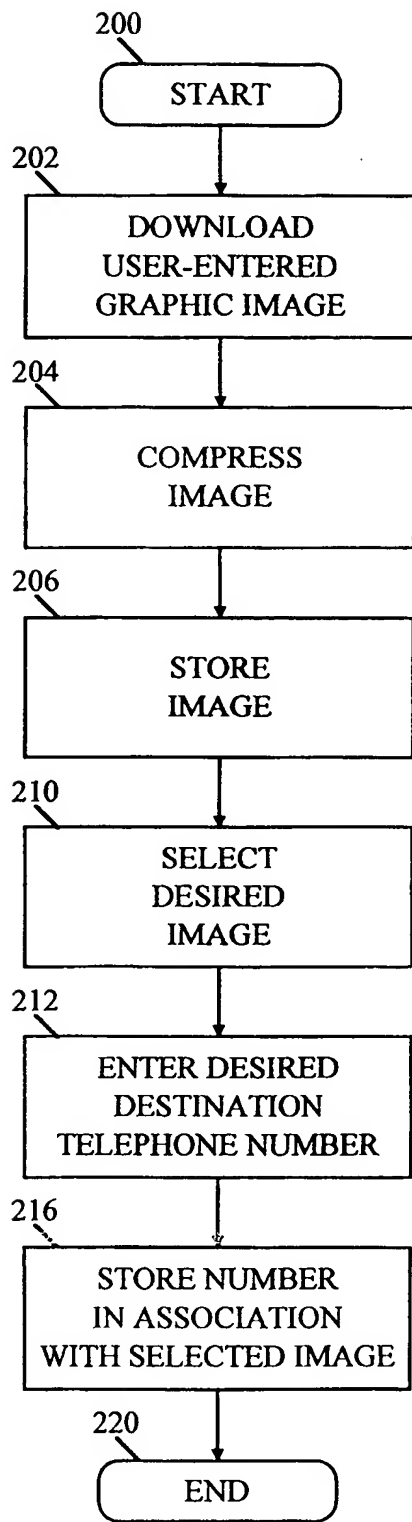
```
                        200
                      ┌─────────┐
                      │  START  │
                      └────┬────┘
                           │
     202                   ▼
          ┌──────────────────────────┐
          │        DOWNLOAD          │
          │       USER-ENTERED       │
          │     GRAPHIC IMAGE        │
          └────────────┬─────────────┘
                       │
     204               ▼
          ┌──────────────────────────┐
          │        COMPRESS          │
          │         IMAGE            │
          └────────────┬─────────────┘
                       │
     206               ▼
          ┌──────────────────────────┐
          │         STORE            │
          │         IMAGE            │
          └────────────┬─────────────┘
                       │
     210               ▼
          ┌──────────────────────────┐
          │        SELECT            │
          │        DESIRED           │
          │         IMAGE            │
          └────────────┬─────────────┘
                       │
     212               ▼
          ┌──────────────────────────┐
          │    ENTER DESIRED         │
          │     DESTINATION          │
          │  TELEPHONE NUMBER        │
          └────────────┬─────────────┘
                       │
     216               ▼
          ┌──────────────────────────┐
          │     STORE NUMBER         │
          │   IN ASSOCIATION         │
          │  WITH SELECTED IMAGE     │
          └────────────┬─────────────┘
                       │
     220               ▼
                    ┌─────────┐
                    │   END   │
                    └─────────┘
```

FIG. 8

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START ⟨230⟩

↓

DISPLAY
GRAPHIC IMAGE
LIST ⟨232⟩

↓

SELECT
DESIRED
IMAGE ⟨234⟩

↓

PLACE ASSOCIATED
TELEPHONE NUMBER
IN DIALED DIGITS ⟨236⟩

↓

INITIATE
CALL ⟨240⟩

↓

STORE TELEPHONE
NUMBER AND GRAPHIC
IMAGE IN CALL
HISTORY ⟨242⟩

↓

END ⟨244⟩
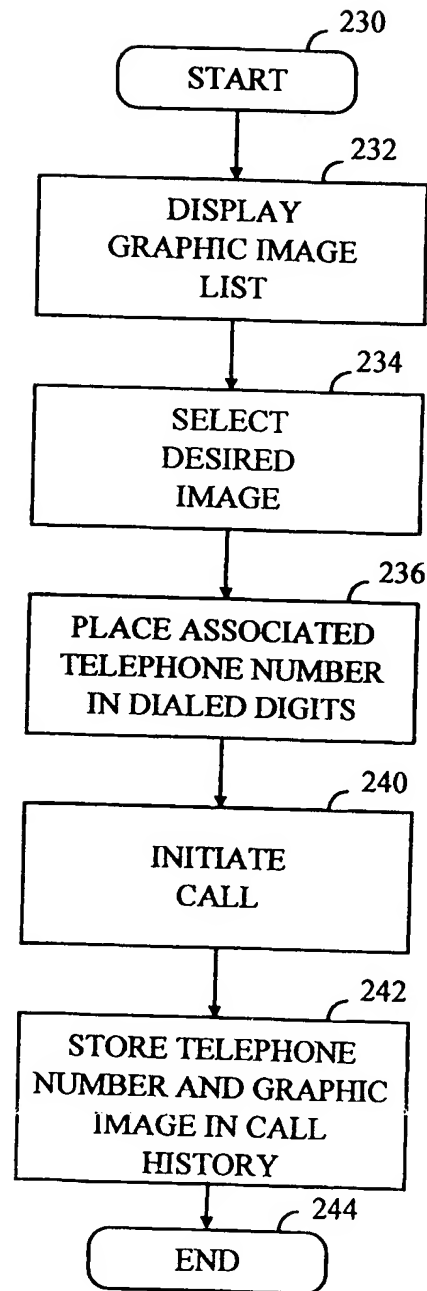
FIG. 9

# INTERNATIONAL SEARCH REPORT

| A. CLASSIFICATION OF SUBJECT MATTER |
|---|
| IPC 7    H04M1/274    H04M1/247 |

According to International Patent Classification (IPC) or to both national classification and IPC

| B. FIELDS SEARCHED |
|---|
| Minimum documentation searched (classification system followed by classification symbols)<br>IPC 7    H04M |

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
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| Y | | 3,5-13,<br>15-17,<br>21,22,<br>25,<br>27-35,37 |
| | —<br>-/— | |

| [X] Further documents are listed in the continuation of box C. | | [X] Patent family members are listed in annex. |
|---|---|---|

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| Date of the actual completion of the international search | Date of mailing of the international search report |
|---|---|
| 16 February 2000 | 23/02/2000 |

| Name and mailing address of the ISA | Authorized officer |
|---|---|
| European Patent Office, P.B. 5818 Patentlaan 2<br>NL – 2280 HV Rijswijk<br>Tel. (+31–70) 340–2040, Tx. 31 651 epo nl,<br>Fax: (+31–70) 340–3016 | Golzio, D |

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**C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT**

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| Y | NIETZER P ET AL: "AN ISDN TERMINAL WITH A GRAPHICAL TELEPHONE INTERFACE EIN ISDN-ENDFERAET MIT GRAPHISHER TELEFONOBERGLAECHE" ITG-FACHBERICHTE,DE,VDE VERLAG, BERLIN, vol. 113, 16 May 1990 (1990-05-16), pages 145-152, XP000618983 ISSN: 0932-6022 paragraphs '02.1!-'02.5! figures 2.1-2.6 | 3,21,22, 25 |
| Y | WO 96 06401 A (APPLE COMPUTER) 29 February 1996 (1996-02-29) abstract page 34, line 10 -page 37, line 17 figure 8 | 15-17,37 |
| Y | "CALLING CARD INTERFACE FOR VISUAL TELEPHONY" IBM TECHNICAL DISCLOSURE BULLETIN,US,IBM CORP. NEW YORK, vol. 35, no. 4B, 1 September 1992 (1992-09-01), pages 291-293, XP000313950 ISSN: 0018-8689 page 291, paragraphs 3,4 page 293, paragraph 1 | 3,21,22, 25 |
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International Application No

PCT/US 99/24760

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| US 5592546 | A | 07-01-1997 | JP | 7095279 A | 07-04-1995 |
| WO 9606401 | A | 29-02-1996 | US<br>AU | 5898434 A<br>3410495 A | 27-04-1999<br>14-03-1996 |
| JP 10214171 | A | 11-08-1998 | NONE | | |
| WO 9848552 | A | 29-10-1998 | US | 5923327 A | 13-07-1999 |